ESL-HH-08-12-24

Air Conditioner Efficiency under Hot Dry and Hot Humid Conditions - The Utility Perspective

Ammi Amarnath
Technical Leader, Energy Efficiency & Demand Response Program
Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94304
E-mail: aamarnath@epri.com
Phone: (650) 855-1007

Energy efficient residential air conditioning is important to utilities and their customers. In almost all parts of the U.S., an air conditioner for a dwelling has a high peak demand compared to its annual use of electricity. The electric grid must be capable of supplying this large load at the critical peak times, such as late afternoons. In general, the peak demand is shifting to later in the afternoon, as it is being pulled by an ever increasing air conditioning load.

A system's Energy Efficiency Ratio (EER) is the cooling energy in Btu/hour divided by the watts of electricity consumed under steady state conditions at 95^{o}. Since the 1980s residential-size air conditioners have had their energy efficiency rated as with a seasonal yardstick, called Seasonal Energy Efficiency Ratio (SEER). As part of the set of laboratory tests and computer simulations required to calculate SEER, air conditioners are run at 82^{o}F and 95^{o}F in steady-state and cycling modes. While SEER has been proven in the market place, the increased focus on annual consumption and peak demand in the field has shown that the SEER rating is in need of improvement. The first step was taken by the utility members of Consortium for Energy Efficiency (CEE) who took the lead of Pacific Gas & Electric Company (PG&E) to establish a set of performance tiers based on the pair of SEER and EER at 95^{o}F, which after negotiations was listed by the Air-conditioning, Heating and Refrigeration Institute (AHRI).

Laboratory and field research supported by utilities and energy efficiency agencies has found that SEER needs further improvement so that it can meet the new demands. Changes in SEER laboratory testing and computer simulations are being proposed to improve the real world relevance of SEER. The importance of climate has been highlighted by the use of advanced, annual simulations that are recognized for their accuracy. The Energy Independence and Security Act of 2007 authorizes the United States Department of Energy (USDOE) the regulatory standing to develop a total of three SEER standards: a national SEER and two regional standards. The hot dry West and the hot humid Southeast and Hawaii are the most likely regions, with the national standard covering the rest of the country. If current regional standards prevail, they may not come into effect for 5 to 10 years.

Utilities can provide leadership to the benefit of their customers and grid reliability by implementing incentive programs that combine a climate-adapted, regional air conditioning performance and efficiency tiers with quality installation programs. These

initiatives can provide significant near-term peak reduction and energy efficiency that support the longer-term federal standards. Recommendations for utility initiatives are summarized below.

Recommendations

- Establish a utility and energy efficiency agency coordinating council for regional standards;
- Identify regional centers to provide the institutional support;
- Develop recommended best practices for regionally based energy efficiency programs;
- Actively engage in the USDOE standards proceedings through technical input from collaborative organizations like EPRI and EEI;
- Support emerging technology procurement of air conditioning equipment that is super-efficient, climate optimized, and has low peak electricity demand.